

## REMARKS

Claims 1-43 are pending in the application and are presented for reconsideration. By the foregoing amendments, claims 1-2, 5, 10-11, 14, 21-22, 25, 30-31, 34, and 40-43 are sought to be amended. New claims 44-45 are added. Based on the above Amendment and the following Remarks, Applicant respectfully requests that the Examiner reconsider all outstanding objections and rejections and withdraw them.

### **Allowable Subject Matter**

The Examiner has objected to claims 2-5, 11-14, 22-25, and 31-34 as being dependent on rejected base claims. Applicant has amended the base claims and believes that the base claims are now in condition for allowance. Applicant has additionally amended claims 2, 5, 11, 14, 22, 25, 31, and 34. Applicant believes these claims, as amended, still contain allowable subject matter. Therefore, in view of the amendments and the remarks below, Applicant respectfully requests that the Examiner remove the objections to the claims.

### **Rejections under 35 U.S.C. §103**

Claims 1, 6-9, 21, 26-29, 40 and 42 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over an article entitled “Nonlinear Dimensionality Reduction by Locally Linear Embedding” by Roweis, et al. in view of an article entitled “Evolutionary Pursuit and its “Application to Face Recognition” authored by Liu, et al. Claims 10, 14-20, 30, 34-39, 41 and 43 have further been rejected as allegedly being unpatentable over Roweis in view of an article entitled “A Mathematical Programming Approach to Kernel Fisher Algorithm” authored by Mika, et al. These rejections are now traversed.

#### **Rejection to claims 1, 6-9, 21, 26-29, 40 and 42**

Representative claim 1 recites:

A method of representing a set of images for pattern classification, the method comprising:

- receiving data points corresponding to the set of images in an input space;
- generating a neighboring graph indicating whether the data points are neighbors;
- estimating pairwise geodesic distances between a first data point and a plurality of other data points based upon the neighboring graph;
- representing the first data point by a first feature vector comprising the estimated pairwise geodesic distances between the first data point and the plurality of other data points; and
- applying Fisher Linear Discriminant to a set of feature vectors including the first featured vector comprising the pairwise geodesic distances between the first data and the plurality of other data points to obtain an optimal direction for projecting the feature vectors for pattern classification.

Claims 21 and 42 recite systems including similar claim language. Claim 40 recites a computer program product including similar claim language. The claimed invention provides a system and method for representing images for pattern classification. Data points corresponding to the images are received and a neighboring graph is generated indicating whether data points are neighbors. Pairwise geodesic distances are estimated between a first data point and a plurality of other data points based on the neighboring graph. The first data point is represented by a feature vector that comprises the estimated pairwise geodesic distances between the first data point and the plurality of other data points. Fisher Linear Discriminant (FLD) is applied to a set of feature vectors including the first feature vector comprising the pair wise geodesic distances between the first data point and the plurality of other data points. This obtains an optimal direction for projecting the feature vectors for pattern classification.

As the Examiner admits, Roweis does not disclose applying FLD to feature vectors. Instead, the Examiner relies on Liu as allegedly disclosing this limitation. However, although Liu discloses an FLD algorithm, Liu does not disclose or suggest applying FLD to a feature

vector comprising the geodesic distances between a first data point and a plurality of other data points. Rather, Liu merely describes applying FLD to a vector that is composed of a set of image classes (Liu, Section 2.2, paragraph 1). Liu does not specifically describe the information contained in the “image classes”, but does not disclose or suggest that an image class would comprises geodesic distances between a first data point and a plurality of other data points.

Even if Liu could be combined with Roweis, the combination still does not disclose or suggest the claimed invention. Rather, the claimed feature vector is different than any vector disclosed in Roweis. Roweis discloses “computing the weights  $W_{ij}$  that best linearly reconstruct  $X_i$  from its neighbors.” (Roweis FIG.2, caption). Thus, as the Examiner points out, a weight can be calculated to help reconstruct a data point with its neighbors. However, although the weights may be based in part on a distance metric, a vector of weights is different than a feature vector comprising the estimated pairwise geodesic distances between a data point and a plurality of other data points. Thus, the feature vector of the claimed invention is not disclosed or suggested in the references.

In the Office Action dated September 13, 2007, the Examiner states that Liu applies a vector to a set of image classes composed of images that are “neighbors” and remarks that this corresponds to the neighbors in Roweis. Roweis discloses determining neighbors and Liu discloses applying FLD to neighboring data points. However, although Liu may operate on image classes representing neighboring data points, the image classes do not comprise geodesic distances between data points. Therefore, claims 1, 21, 40 and 42, as amended, are patentable over Roweis and Liu. The dependent claims incorporate all the limitations of their respective base claims and are patentable for at least the same reasons.

#### Rejection to claims 10, 14-20, 30, 34-39, 41 and 43

Claims 10, 30, 41, and 43 recite a method, systems, and a computer program product similar to claims 1 and 21, 40 and 42 respectively, but apply Kernel Fisher Linear Discriminant instead of Fisher Linear Discriminant to the feature vectors comprising the geodesic distances. Although Mika discloses applying KFLD to a feature vector of neighboring data points, the feature vector does not comprise geodesic distances between a data point and each other data point. Therefore, claims 10, 30, 41 and 43, as amended, are patentable over Roweis and Mika. The dependent claims incorporate the limitations of their respective base claims and are patentable for at least the same reasons. Applicant respectfully requests that the Examiner reconsider the rejections and withdraw them.

### **Conclusion**

Applicant has properly accommodated or addressed all of the stated grounds of objection and rejection set forth by the Examiner in the Office Action. Applicant, therefore, respectfully requests that the Examiner reconsider all presently outstanding objections and rejections and withdraw them. The Examiner is invited to telephone the undersigned representative if it is felt that an interview might be useful for any reason.

Respectfully submitted  
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